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Indian Standard

SPECIFICATION FOR 35 mm PORTABLE MOTION PICTURE PROJECTORS

(First Reprint SEPTEMBER 1999)

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

Gr 4 *September* 1973

AMENDMENT NO. 1 JANUARY 1974

TO

IS : 6933-1973 SPECIFICATION FOR 35 mm PORTABLE MOTION PICTURE PROJECTORS

Corrigenda

(*Page* 4, *clause* **3.3**, *line* 2) — Substitute 'lenses' *for* 'len es'.

(*Page* 5, *clause* **3.6.4**, *line* 2) — Substitute 'injury' *for* 'inquiry'.

(*Page* 9, *clause* **5.5**, *line* 3) — Substitute '0·3' *for* '9·3'.

(ETDC 47)

Reprography Unit, BIS, New Delhi, India

AMENDMENT NO. 2 OCTOBER 1976

TO

IS:6933-1973 SPECIFICATION FOR 35 mm PORTABLE MOTION PICTURE PROJECTORS

Alterations

(Page 13, clause 5.14.3, line 2) - Substitute '7.13.1.1 of IS:7741(Part I)-1975*' *for* '4.8.1 of IS:1031-1967*'.

[Page 13, foot-note with an asterisk(*) mark] - Substitute the following for the existing foot-note:

> '*Specification for loudspeakers : Part I General requirements and tests.'

(ETDC 47)

Reprography Unit, BIS, New Delhi, India

Indian Standard
SPECIFICATION FOR 35 mm PORTABLE MOTION PICTURE PROJECTORS

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(*Continued on page* 2)

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Indian Standard

SPECIFICATION FOR 35 mm PORTABLE MOTION PICTURE PROJECTORS

0. FOREWORD

0.1 This Indian Standard was adopted by the Indian Standards Institution on 6 July 1973, after the draft finalized by the Cinematographic Equipment Sectional Committee had been approved by the Electrotechnical Division Council.

0.2 This standard deals with 35 mm portable motion picture projectors. It relates principally to those requirements which ensure a satisfactory picture and sound performance, safety and film life. It does not deal with the details of the mechanical and electrical designs and construction of projectors except in so far as such details may affect performance or convenience in use.

0.3 Thirty-five millimetre portable motion picture projectors normally employ incandescent lamps as the light sources. The lumen output values specified in this standard relate to those using incandescent lamps as the light sources.

0.4 The Committee responsible for the preparation of this standard gave thought to the need for specifying the requirement for permissible noise level of projector mechanism but felt that due to inadequate data available, such requirement could not be specified at present. It is, however, hoped that at the time of revision of this standard, such requirement would be specified.

0.5 In preparing this standard assistance has been derived from the publication 'Standard electrical characteristics for theatre sound system' published by the Motion Picture Research Council of USA and MIL-P-49C 'Military specification for projection sets, motion picture, sound 16 mm and component parts' issued by United States Departments of the Army, the Navy and the Air Force.

0.6 For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test, shall be rounded off in accordance with IS : 2-1960*. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

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*Rules for rounding off numerical values (*revised*).

1. SCOPE

1.1 This standard lays down the safety and performance requirements of 35 mm portable motion picture projectors with optical or magnetic sound systems or both intended to be operated with incandescent lamps and for a rated voltage not exceeding 250 V.

2. TERMINOLOGY

2.0 For the purpose of this standard, the following definitions and those given in IS : 1885 (Part XXXIV)-1972* shall apply.

2.1 Type Tests — Tests carried out to prove conformity to the requirements of this standard. These are intended to check the general qualities and design of a given type of projector.

2.2 Acceptance Tests — Tests carried out on samples selected from a lot for the purpose of acceptance of the lot.

2.3 Routine Tests — Tests carried out on every projector to check the requirements which are likely to vary during production.

3. DESIGN AND CONSTRUCTION

3.1 General Design — The projectors shall be designed for the satisfactory projection of 35 mm cinematograph film using spools or film loads appropriate to the maximum capacity of the projector as determined by the manufacturer.

3.1.1 The projector shall be capable of satisfactorily projecting, without adjustment, film which has shrunk by 0·7 percent from the original dimension of the film.

NOTE — It is recommended that the generally accepted practice of right-hand operation be followed.

3.2 Speed of Projection — The speed of projection for sound films shall be 24 frames per second ± 2½ percent.

3.3 Accessibility of Optical Parts for Cleaning — All external surfaces of the condenser lenses, both external surfaces of the projector lens, and the exposed surfaces of all mirrors and filters shall be accessible for cleaning without the use of tools.

3.4 Picture Aperture — The picture aperture and all surfaces which make contact with the film, shall be easily accessible for cleaning.

3.5 Framing — Means of framing shall be provided, giving a total range of not less than 7·5 mm about the mean position.

NOTE — It is highly desirable that the means provided shall be such that, when operated, the position of the illuminated area on the screen is not affected.

---

*Electrotechnical vocabulary: Part XXXIV Cinematography.

3.6 Electrical and Safety Requirements

3.6.1 The equipment shall be so insulated and protected that there shall be no danger from electrical shock or fire, and provision shall be made for the efficient earthing of all metal parts likely to become live in the event of failure of any part of the insulation.

3.6.1.1 The earthing terminal shall be clearly and indelibly indicated by the symbol ⏚.

3.6.2 The electrical circuits of the projector lamp and the ventilator motor, if any, shall be so interconnected that the projector lamp cannot be switched on unless the ventilator motor is energized.

3.6.3 *Abnormal Operation* — The projector shall be so designed that risk of fire, mechanical damage or electric shock as a result of abnormal or careless operation is obviated as far as possible.

NOTE — Fusible links, thermal cut-outs, overcurrent releases and similar devices may be used to enable projectors to comply with this clause.

3.6.4 *Mechanical Hazards and Stability* — Moving parts shall be so arranged or enclosed as to provide adequate protection against personal inquiry so far as is compatible with the normal use and working of the projector. Protecting enclosures, guards and the like shall have adequate mechanical strength. They shall not be removable without the use of a tool unless normal use necessitates the removal of such parts.

3.7 Light Source — Provision shall be made to ensure that proper positioning and alignment of the lamp is maintained.

3.8 Adequacy of Lamphouse Ventilation — The continuous operation of the projector at its rated voltage for a period of three hours, using a projection lamp of the highest wattage recommended by the manufacturer, and with an ambient temperature of 40 ± 2°C shall cause no bulging of the lamp envelope or other damage to lamp or to the projector due to overheating.

3.9 Alignment and Position of Film Plane — When viewed from a distance from the screen equal to twice the width of the picture, and with central framing, the four corners of the image of a normally projected film shall appear to be equally in focus.

The design of the lens mount and the gate shall be such that focus adjustment is maintained after opening and closing the gate.

3.10 Tilting Adjustment — The projector shall have a wide tilting adjustment to permit correct alignment of the screen image size with the vertical for a tilt not less than 2° at either side. There shall also be provision for tilting the projector from 10° above the horizontal.

3.11 Provision for Double-Projector System. — Provision shall be made for accommodating additional photo-electric cell (PEC) on the amplifier unit in order to facilitate operation when double-projector system is required.

3.12 Maximum Weight — Maximum permissible weight of the equipment shall be as follows:

Single projector	40 kg
Amplifier	25 ,,
Speaker	20 ,,
Lower and upper magazine	15 ,,

NOTE — For certain designs it might become necessary to have voltage transformers and in that case the weight of such transformer has been excluded.

3.13 Flicker — For the projection speed of 24 frames per second at least two equal obscurations per frame shall be provided.

4. MARKING

4.1 The following information shall be clearly and indelibly marked:

a) Name and/or trade-mark of the manufacturer or supplier;
b) Type and serial number;
c) Rated voltage, frequency and power input;
d) Voltage and maximum wattage of the projection lamp to be used; and
e) Country of manufacture.

4.1.1 The projectors may also be marked with the ISI Certification Mark.

NOTE — The use of the ISI Certification Mark is governed by the provisions of the Indian Standards Institution (Certification Marks) Act and the Rules and Regulations made thereunder. The ISI Mark on products covered by an Indian Standard conveys the assurance that they have been produced to comply with the requirements of that standard under a well-defined system of inspection, testing and quality control which is devised and supervised by ISI and operated by the producer. ISI marked products are also continuously checked by ISI for conformity to that standard as a further safeguard. Details of conditions under which a licence for the use of the ISI Certification Mark may be granted to manufacturers or processors, may be obtained from the Indian Standards Institution.

4.2 Threading diagrams and warning plates in applicable locations shall be attached in a permanent manner on the projector.

5. TESTS

5.1 Classification of Tests

5.1.1 *Type Tests* — The following shall constitute type tests:

a) High voltage test (*see* 5.2),
b) Insulation resistance test (*see* 5.3),

c) Test for light output (*see* **5.4**),
d) Test for film wear (*see* **5.5**),
e) Test for temperature-rise (*see* **5.6**),
f) Test for picture steadiness (*see* **5.7**),
g) Test for travel-ghost (*see* **5.8**),
h) Test for lens resolution (*see* **5.9**),
j) Test for uniformity of screen illumination (*see* **5.10**),
k) Test for colour bands in the image (*see* **5.11**),
m) Test for amplifier (*see* **5.12**),
n) Test for amplifier and sound reproducer (*see* **5.13**), and
p) Test for loundspeaker (*see* **5.14**).

5.1.2 *Acceptance Tests* — The following shall constitute acceptance tests:

a) High voltage test (*see* **5.2**),
b) Insulation resistance test (*see* **5.3**),
c) Test for picture steadiness (*see* **5.7**),
d) Test for travel-ghost (*see* **5.8**),
e) Test for uniformity of screen illumination (*see* **5.10**),
f) Test for lens resolution (*see* **5.9**),
g) Test for system gain (*see* **5.13.1**),
h) Test for system noise (*see* **5.13.2**), and
j) Test for system frequency response (*see* **5.13.5**).

5.1.3 *Routine Tests* — The following tests shall be carried out as routine tests:

a) High voltage test (*see* **5.2**),
b) Insulation resistance test (*see* **5.3**),
c) Test for picture steadiness (*see* **5.7**),
d) Test for travel-ghost (*see* **5.8**),
e) Test for lens resolution (*see* **5.9**),
f) Test for uniformity of screen illumination (*see* **5.10**), and
g) Test for colour bands in the image (*see* **5.11**).

5.2 High Voltage Test — There shall be no flashover or break-down during the test when a projector is subjected to the following test.

5.2.1 Remove the lamps and subject the insulation for 1 minute to an ac voltage of substantially sine-wave form, with any suitable frequency between 40 and 60 Hz.

5.2.2 Apply the test voltage between the parts indicated in Table 1, the value of the voltage being as indicated in that table.

TABLE 1 TEST VOLTAGE

SL No.	POINTS OF APPLICATION OF TEST VOLTAGE	TEST VOLTAGE V
(1)	(2)	(3)
i)	Between live parts and metal parts that are separated from live parts by:	
	functional insulation	1 000
	reinforced insulation	4 000
ii)	Between live parts and metal foil on accessible surfaces of insulating material if there is no intermediate metal or the test of Sl No. 4 cannot be made	3 500
iii)	Between live parts of different polarity	1 000
iv)	For parts with double insulation, between metal which is separated from live parts by functional insulation only and live parts across functional insulation	1 000
v)	Accessible metal enclosure or metal foil in contact with accessible surfaces of insulation material across protective insulation	2 500
vi)	Between metal foil in contact with the surface of handles, knobs, grips and the like and their shafts if these shafts can become live in the event of an insulation fault	2 500
vii)	Between accessible metal parts in all insulated or double insulated construction and either metal foil wrapped round the supply flexible cord inside the inlet bushings, cord guards, cord anchorages and the like, or a metal rod of the same diameter as the cord, inserted in its place	2 500
viii)	Between the inner and outer surface of sleeves or the like used as protective insulation in all or double construction	2 500

5.2.3 Initially apply not more than half the prescribed voltage, then raise it rapidly to the prescribed value.

5.2.4 Take care when applying the metal foil to see that adequate clearance is maintained between the foil and external metal parts in order to avoid coverstressing the insulation between live parts and earthed metal parts, and when testing reinforced insulation to ensure that the protective insulation is not overstressed.

5.3 Insulation Resistance Test — The insulation resistance shall be not less than the following limits when tested according to **5.3.1**:

For functional insulation	1 MΩ
For protective and reinforced insulation (including insulation with metal foil on the outer surface)	10 MΩ

5.3.1 Immediately after the voltage test, measure the insulation resistance with 500 V dc, the test voltage being obtained from an independent source or generated in the measuring instrument. Carry out the test as follows:

a) Between live parts and the following parts connected together:
   1) accessible metal parts;
   2) metal foil on external parts of insulating material; and
   3) shafts of handles, knobs, grips and the like, if of metal, and if the handles, etc, can be removed without tools; and

b) Between live parts of different polarity as far as the necessary disconnections can be made without damaging the projector.

5.4 Test for Light Output

5.4.1 When tested by the method described in IS : 4495-1968* the light output of the projector shall be not less than 550 lumens.

NOTE — The specified light output alone is not the sole criterion of the optical performance of the projector but the colour temperature of the light is also important. The generally accepted so called 'white' light, which is necessary for projection of colour films, is obtained from light sources having colour temperature of the order of 3 200°K.

5.5 Test for Film Wear — A 4-m loop of newly processed and lubricated sound and picture film in good condition, having a shrinkage not greater than 9·3 percent, shall be threaded through all parts of the projector mechanism that touch the film in normal operation. The loop shall be supported in the return path in as near a normal position as possible by free-running idler rollers of such construction as to have a negligible tendency to damage the film. The loops shall be under a tension of not less than 50 g nor more than 200 g. The loops shall be passed through the projector mechanism for 1 000 times, with a lamp that will comply with the requirements of **5.4**, and the film examined for visible damage by projection and audible damage by listening. The perforations shall also be examined for damage. The splices shall be replaced as may be necessary during the test. For magnetic projectors this test shall also be conducted with oxide coated film.

5.5.1 During the test, the test room shall be closed and otherwise well protected against dust.

5.5.2 At the end of the test there shall be no visible evidence of damage in the projected picture and no audible evidence of damage to the sound track in the reproduced sound. Close inspection of the film with the unaided eye shall reveal no evidence of damage at the sprocket holes.

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*Methods of measurement of light output of cinematograph projectors (for narrow gauge film).

5.6 Test for Temperature-Rise — The projector, exciter lamp and all other sources of heat shall be operated continuously at the rated voltage and at an ambient temperature of 40 ± 2°C. The temperature-rise at the hottest spot of the projector housing, exclusive of the top cover of the lamp house, shall be determined by the thermocouple method when two hours have elapsed. The temperature-rise shall not exceed 30°C above the ambient.

5.7 Test for Picture Steadiness — The projector, when tested on forward running with the registration test film shall comply with the following requirements for picture steadiness:

a) The maximum vertical picture unsteadiness shall not exceed 0·3 percent of the picture width, and

b) The maximum horizontal picture unsteadiness shall not exceed 0·2 percent of the picture width.

5.8 Test for Travel-Ghost

5.8.0 *Definition of Travel-Ghost* — Travel-ghost is a blurred effect on the screen during film projection with vertical tails or streaks of light, and caused by failure of the projector shutter to cover the film during its shift.

5.8.1 *Test Film* — The registration test film as specified in 'Indian Standard specification for registration test film (35 mm) (*under preparation*)' shall be used.

5.8.2 *Test Method* — The projector shall be set up facing matt white screen and position so as to produce a picture between 2 and 3 m wide. The test film shall then be projected at the speed or speeds at which the projector is designed to operate. The screen image of the test film shall be viewed from a distance equal to twice the picture width and the absence or presence of travel-ghost shall be noted.

5.9 Test for Lens Resolution — The projector lens shall resolve not less than 90 lines/mm at the centre of the picture and 40 lines/mm at its corners.

NOTE — The resolving power of a lens is only a partial answer to the question 'What is the image quality'? It measures only the minimum size of detail which is visually observable. Nevertheless, if test objects of a suitably chosen fixed contrast are used, figures for resolving power are usually sufficiently meaningful to be of use.

5.10 Test for Uniformity of Screen Illumination — With the projector running without film in the gate the luminance of each side of the screen measured on the horizontal axis shall be not less than 0·6 times the measured luminance at the centre, and should preferably be as near as practicable to 0·7. There shall be no change in uniformity so abrupt as to be apparent to the eye.

5.11 Test for Colour Bands in the Image — For the purpose of compliance with this clause, the projector shall be set up for projection with a film in the gate, the film shall be projected and focussed on to a screen of appropriate dimensions; the film shall be removed and a neutral density filter of density 0·6 shall be placed in front of the lens. The screen shall then appear to be free from colour bands or fringes.

5.12 Tests for Amplifier

5.12.1 *Rated Power Output and Distortion* — The rated power output shall not be less than 15 W. At the rated output, harmonic distortion shall not exceed 3 percent at any frequency between 120 and 3 000 Hz.

5.12.2 *Frequency Response* — The frequency response shall be within ±2·0 dB between 50 and 7 000 Hz and shall be measured at half the rated output with a resistive load and at the reference frequency of 1 000 Hz.

5.13 Tests for Amplifier and Sound Reproducer

5.13.1 *System Gain* — The amplifier should have enough available gain to produce at least 20 dB in excess of that required to produce half the rated power output, the signal being obtained from 1 000 Hz signal level test film as specified in IS : 6562-1972*.

Adequacy of reserve gain may be determined by inserting in the optical path of this soundhead a neutral filter of density of $0\cdot6\ ^{+0}_{-0\cdot5}$ then with the 1 000 Hz test film running through the projector and the tone control in the nominally normal position, it will be possible to obtain the rated power output of the amplifier, if there is adequate gain.

NOTE — Care should be taken to ensure that the filter used has the appropriate characteristic density throughout the special band involved.

5.13.2 *System Noise* — When measured in the manner specified in Appendix A the system noise shall be at least 50 dB below the full rated output.

5.13.3 *Uniformity of Scanning-Beam Illumination* — The uniformity of scanning-beam illumination shall be such that the output from the reproducer amplifier does not vary by more than ±1·5 dB when a uniformity of scanning-beam illumination test film conforming to IS : 6564-1972† is run through the reproducer.

5.13.4 *Flutter* — The flutter introduced by the reproducer shall not exceed 0·25 percent when using the flutter test film conforming to 'Indian Standard specification for flutter test film (*under preparation*)'.

NOTE — This value has been selected as the maximum permissible value as measured on a RCA Flutter Bridge or on an instrument that has been adjusted to give comparable readings.

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*Specification for 1 000 Hz balancing and signal level test film.

†Specification for scanning-beam uniformity test film.

5.13.5 *Frequency Response of the System* — With the nominally normal position of the tone control, the output signal voltage produced by multi-frequency sound track of uniform sound depth should lie within the limits given in Fig. 1,

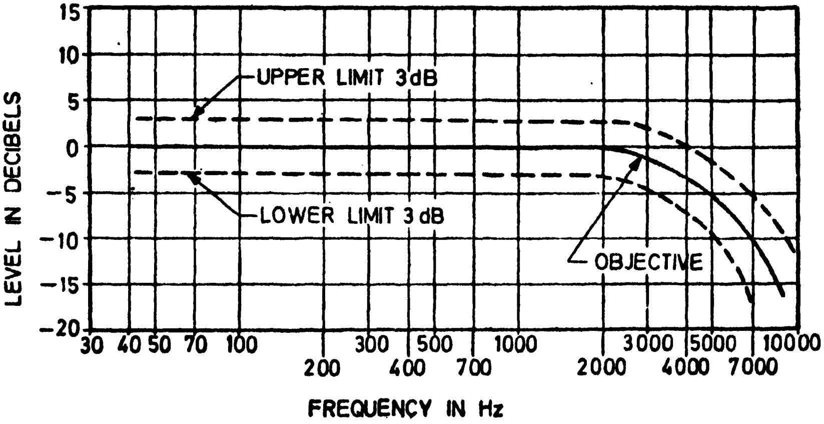

Fig. 1 Frequency Response Characteristic for Sound Reproducer and Amplifier

5.13.6 *Tone Control* — Tone control shall be provided. It shall incorporate a tone control for bass and treble with a minimum range of ±6 dB referred to 1 000 Hz.

5.14 Tests for Loudspeaker

5.14.1 *Power Handling Capacity* — The power handling capacity shall be such that an input of representative programme material with peaks of 15 W as measured on an oscilloscope, will not generate distortion, spurious noise or rattles.

5.14.2 *Frequency Response Characteristic*

5.14.2.1 The loudspeaker shall be set up under free field conditions and a constant voltage signal (of such value as to deliver 5 W to the loudspeaker at 800 to 1 250 Hz) shall be impressed across the loudspeaker voice coil at a frequency which shall be varied continuously from 80 to 8 000 Hz. The output sound pressure shall be measured on the loudspeaker sound axis at a distance of 3 m.

5.14.2.2 The frequency response characteristic of the loudspeaker shall fall within the limits shown in Fig. 2. The mean of the measured response curve shall have a slope closely following the slope of the design objective except that sharp peaks and dips may extend beyond these limits provided that the width at the limits is not greater than 1/10 octave, and there is no more than one such extension in any octave interval.

NOTE — The output sound pressure over the 800 to 1 250 Hz warble band shall not necessarily be the zero reference level on Fig. 2.

5.14.3 *Harmonic Distortion* — The test for harmonic distortion shall be carried out in accordance with **4.8.1** of IS : 1031-1967*.

NOTE — The permissible value for harmonic distortion is under consideration and will be added later.

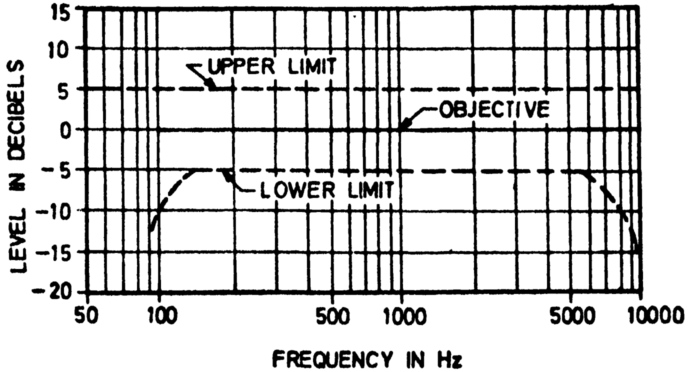

FIG. 2 FREQUENCY RESPONSE CHARACTERISTIC FOR LOUDSPEAKER

APPENDIX A

(*Clause* 5.13.2)

METHOD OF MEASUREMENT OF SYSTEM NOISE

The tone control shall be set to the normal position and the gain control shall be set so that the amplifier delivers half its rated output power into a resistive load equal to its rated load impedance, the signal being obtained from a 1 000 Hz signal level test film as described in IS : 6362-1972†. Then with the test film removed, a neutral filter of density $0{\cdot}6^{+0}_{-0{\cdot}5}$ inserted in the optical path of the soundhead, the projector run, the noise shall be measured as the power developed in the load resistance; the measuring instrument should have a frequency characteristic

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*Methods of measurements on loudspeakers and loudspeaker systems (*first revision*).

†Specification for 1 000 Hz balancing and signal level test film.

equivalent to ' Type A ' weighting network as specified in IS : 3932-1966*. The noise power so measured shall be expressed as a ratio, in dB, relative to the rated power output.

NOTE — The density specified in this appendix corresponds to an attenuation of 12^{+0}_{-1} dB, but care should be taken to ensure that the filter used has the appropriate characteristic density throughout the spectral band involved.

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*Specification for sound level meters for general purpose use.

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5-8-56C, L.N. Gupta Marg, Nampally Station Road, HYDERABAD 500001	320 10 84
E-52, Chitranjan Marg, C- Scheme, JAIPUR 302001	37 38 79
117/418 B, Sarvodaya Nagar, KANPUR 208005	21 68 76
Seth Bhawan, 2nd Floor, Behind Leela Cinema, Naval Kishore Road, LUCKNOW 226001	21 89 23
NIT Building, Second Floor, Gokulpat Market, NAGPUR 440010	52 51 71
Patliputra Industrial Estate, PATNA 800013	26 28 08
Institution of Engineers (India) Building, 1332 Shivaji Nagar, PUNE 411005	32 36 35
'Sahajanand House' 3rd Floor, Bhaktinagar Circle, 80 Feet Road, RAJKOT 360002	36 85 86
T.C. No. 14/1421, University P. O. Palayam, THIRUVANANTHAPURAM 695034	32 21 04

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*Sales Office is at 5 Chowringhee Approach, P.O. Princep Street, CALCUTTA 700072	27 10 85
†Sales Office is at Novelty Chambers, Grant Road, MUMBAI 400007	309 65 28
‡Sales Office is at 'F' Block, Unity Building, Narashimaraja Square, BANGALORE 560002	222 39 71

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